Systems and equipment in use at U.S. Coast Guard Vessel Traffic Services

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Vessel Traffic Services (VTS) operations and equipment requirements

As authorized by the Ports and Waterways Safety Act, The Coast Guard has established Vessel Traffic Services (VTS) in certain ports and waterway areas to maximize the safe and efficient use of waterways by preventing marine accidents and their associated environmental damage. In order to carry out their duties, VTSs use a variety of communications, surveillance equipment, and operating systems to disseminate navigation safety information and exercise regulatory authority when necessary. VTSs also use their capabilities to support other Coast Guard mission areas such as maritime security, aids to navigation, search and rescue (SAR) and law enforcement.

International guidelines for VTS from the International Maritime Organization (IMO) state that a VTS "should have the capability to interact with the traffic and to respond to traffic situations developing in the VTS area." In order to do this, the VTS must maintain a "VTS traffic image - the surface picture of vessels and their movements in a VTS area." The IMO guidelines further state "The VTS should be able to compile a traffic image, which is the basis for its capability to respond to traffic situations developing in its service area. The traffic image allows the VTS operator to evaluate situations and make decisions accordingly. Data should be collected to compile the traffic image."

Beyond these high-level requirements, the International Association of Lighthouse Authorities and Marine Aids to Navigation (IALA) has developed detailed guidelines and recommendations for VTS equipment. Therefore, there are extensive requirements for equipment, sensors and systems used in VTS. The U.S. Coast Guard has used this international guidance to develop VTS system requirements used in the development and acquisition of VTS systems. The ultimate purpose of this equipment is to enable the VTS operator to develop a traffic image in order to communicate information, recommendations and direction to vessels in the VTS area.

Background and evolution of US VTS systems

1970s-1990s: Manual vessel tracking

The earliest VTS systems employed manual tracking and determined vessel locations by radar, visual, and voice communications. VTS operated using vessel data cards upon which pertinent vessel information was written by the VTS operator. The cards were then positioned on a plotting table with a graphic representation of the VTS area (diagram, map or chart). Radar was integrated into this process, which served to enhance operator accuracy in positioning vessels.

1990s: Coast Guard Vessel Traffic System (CGVTS)

Following the EXXON VALDEZ oil spill in 1989 and in recognition of the advances in technology, the Coast Guard developed and deployed the Coast Guard Vessel Traffic System (CGVTS). This system was intended to take radar information which had been previously displayed on a separate analog display and integrate it electronically with other information of use to the VTS operator. CGVTS allowed vessels to be automatically tracked and displayed on an electronic representation of the VTS area with other vessel data. Other operational information, such as the status of aids to navigation, weather information and special operations could also be displayed. CGVTS originated as a modified version of a system developed by the Naval Air Warfare Center (NAWC). CGVTS has been extensively modified and developed to meet VTS-specific requirements. The core system is compliant with the Defense Information Infrastructure Common Operating Environment (DII COE), which allows for interoperability with other DII COE

systems used by other Coast Guard and DOD assets. CGVTS integrates data obtained from multiple sensors, including radar, Automatic Identification System (AIS), VHF-FM voice, and video. The integrated data is presented on a graphic display, which also incorporates electronic charts. This data integration was a tremendous improvement in data collection, enhancing situational awareness and allowing VTS operators to improve their evaluation of the traffic image. CGVTS was originally deployed in four ports: New York, Houston/Galveston, San Francisco, and Puget Sound, and is currently the primary VTS system in Puget Sound and San Francisco.

1990s – Present: Ports and Waterways Safety System (PAWSS) MTM-200

While CGVTS was being developed and deployed, the Coast Guard began a major acquisition project for an advanced VTS system. Initially established in 1994 as the VTS2000 project, in 1997 it was redirected by Congress to ensure stakeholder input was considered, and the project was relaunched as the Ports and Waterways Safety System (PAWSS). A guiding principle of the PAWSS acquisition was to rely as much as possible on commercial, off-the-shelf equipment and to include the Automatic Identification System (AIS) as a primary capability. AIS is an international standard for ship-to-ship, ship-to-shore, and shore-to-ship data communication. AIS was under development by several international bodies during the PAWSS project, and AIS standards were not finalized until 2002. Lockheed-Martin Corporation was awarded the PAWSS contract and based their design on their Marine Traffic Management (MTM) software and system architecture, which consists of communications and decision support equipment as well as sensors. The current version of the system, the MTM-200, is deployed in New York, Houston/Galveston, Port Arthur, Berwick Bay (Morgan City), Lower Mississippi River (New Orleans), St. Mary's River (Sault Ste. Marie) and Prince William Sound (Valdez). The MTM-200 is partially deployed in San Francisco and Puget Sound.

Non-Standard Systems

The Coast Guard operates VTS in three other ports that have neither the MTM-200 nor the CGVTS system. Louisville, KY is the site of a small VTS that is only in operation when the Ohio River is at a stage hazardous to vessel operations. VTS Louisville does not have a VTS operating system but relies on CCTV cameras and vessel voice radio reports to manage vessel traffic. AIS capability and an off-the shelf vessel tracking software system are being installed to automate some of the vessel tracking functions. In Tampa and Los Angeles-Long Beach (LA-LB), the Coast Guard operates VTS in partnership with local entities. In LA-LB, the Marine Exchange of Southern California hosts the VTS and owns the system and sensors. They have a Norcontrol VTS system. The Tampa Port Authority hosts the VTS in Tampa Bay, which is not yet fully operational. They are currently using a Norcontrol system, but as the VTS is brought into full operation other systems and capabilities are being evaluated.

Differing VTS systems

VTSs have different systems for two primary reasons. First, the smaller VTSs have different requirements (Louisville) or requirements that are being met by our VTS partners (i.e., LA-LB and Tampa). Second, funding constraints near the end of the PAWSS acquisition in 2003-2004 drove the decision to use CGVTS for VTS operations at San Francisco and Puget Sound. To ensure San Francisco and Puget Sound were able to obtain AIS capability, funds appropriated in 2004 for the deployment of nationwide AIS capability were used to install the AIS portion of the MTM-200. While CGVTS is the primary system used for day-to-day VTS operations in San Francisco and Puget Sound, the MTM-200 controls the AIS equipment (including replay of vessel tracks for post-casualty investigation and analysis) and feeds the AIS signal to the CGVTS system. We are reviewing VTS requirements to determine the best single system for Puget Sound and San Francisco.

VTS equipment capabilities and comparison

The below tables compare the primary VTS systems and sensors in use at Coast Guard VTSs. Following the tables are images depicting the appearance of one system compared to the other. The following sensor ranges are typical for the various equipment installed at VTS locations; actual ranges are dependent upon many factors including the physical characteristics and requirements for each waterway and the specific equipment installed. For example, in Puget Sound, radars need a range of over 20 miles to provide surveillance of the wider parts of the Strait of Juan De Fuca, whereas in New Orleans radars need only see the relatively short (2-5 miles) stretch of the Mississippi River.

Sensor	Range
Radar	approximately 20 nautical miles (nm), resolution decreases with range.
VHF radio	30nm depending on topography, buildings, local interference, etc.
AIS	15-30nm, depending on topography, local interference, etc. Much shorter range (~10nm) if maximum report rate from vessels is required or many AIS-equipped vessels in the area; greater range (40+nm) if lesser report rate is required.
CCTV	2-5nm

VTS systems and equipment comparison table

	MTM-200 (PAWSS)	CGVTS 4.5.8

System Integration	Lockheed-Martin proprietary software on commercial off-the-shelf (COTS) hardware (mainly Dell Windows platforms)	Government off-the-shelf (GOTS) software loaded on COTS hardware
Charts	Vector electronic nautical charts, international S-57 standard.	DNC charts edited via vector product format (VPF) chart editor
Where in use	Prince William Sound, Houston-Galveston, Port Arthur, Berwick Bay, Lower Mississippi River, New York, St. Marys River, Puget Sound, San Francisco	Puget Sound, San Francisco
Operating System	Windows NT; Windows Servers 2000	Unix, Based on Defense Information Infrastructure Common Operating Environment) DII COE.
Databases	Oracle	Oracle
Radar	Terma Scanter 2001	Terma Scanter 2001, Furuno
AIS	Saab R30/R40, transmit and receive	Saab R30/R40, receive only
CCTV	Pelco/Cohu	Pelco
VHF FM voice communications	Zetron/Various	Zetron
Voice comms recorder	Wordnet	Voiceprint
Vessel track record/replay	Can replay multiple system tracks, AIS and radar video simultaneously on the MTM-200, replay can be captured and exported as video files	Can display historical vessel locations, system track data can be exported for analysis in other applications.
Interoperability	Module written to convert MTM-200 system tracks to OTH Gold format for USCG COP and DoD systems	Native ability to provide system track data in OTH Gold format

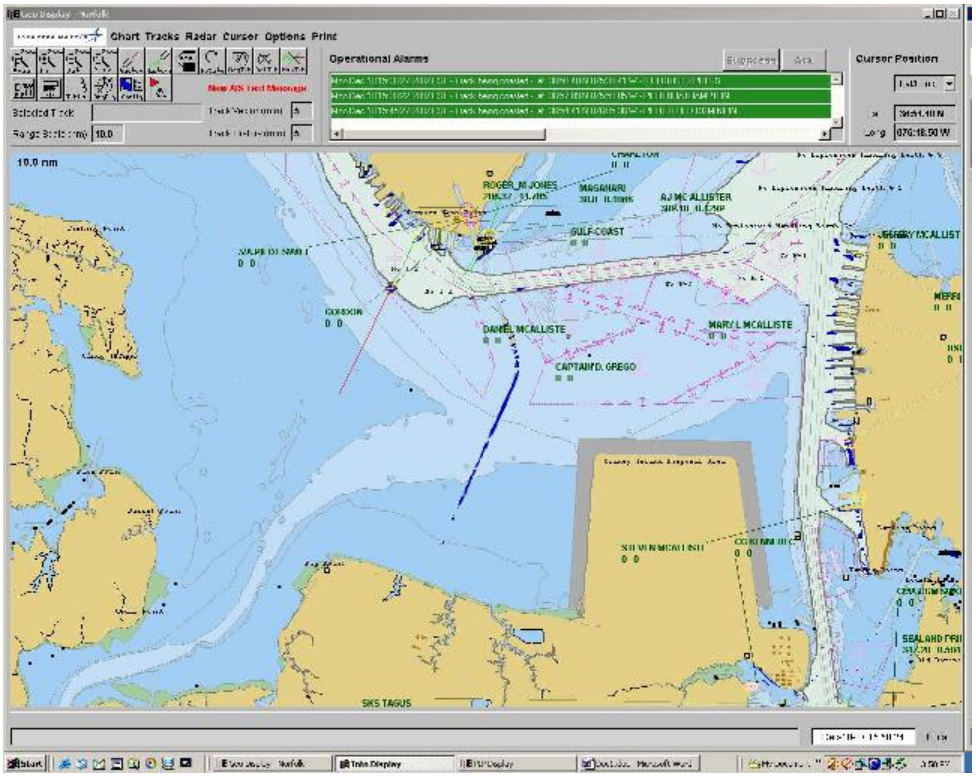
Existing VTS System and Sensor Distribution (See Note 1) As of 2007				
Port Name	**Automated VTS System**	**Radar**	**CCTV**	**VHF**
Lower Mississippi River, LA	MTM-200	Terma Scanter 2001	COHU	Modified Motorola Command Plus/Quantar System **(Note 3)**
Prince William Sound, AK	MTM-200	Terma Scanter 2001	Non Standard PELCO System	NDS System
Berwick Bay, LA	MTM-200	Terma Scanter 2001	PELCO	Standalone Motorola Quantar & Command Plus
Sault Ste Marie, MI	MTM-200	N/A	COHU	NDS System
New York	MTM-200	Terma Scanter 2001	PELCO	Zetron & Quantar system
Houston / Galveston, TX	MTM-200	Terma Scanter 2001	PELCO	Zetron & Quantar system
Port Arthur, TX	MTM-200	Terma Scanter 2001	COHU & FLIR	PAWSS deployed unique system
Puget Sound, WA	Hybrid MTM-200/CGVTS	Terma Scanter 2001, Furuno **(See Note 2)**	PELCO	Zetron & Quantar system
San Francisco, CA	Hybrid MTM-200/CGVTS	Terma Scanter 2001, Furuno	PELCO	Zetron & Quantar system
Louisville, KY	N/A Sensors Only	N/A	PELCO	NDS System

Note 1) All AIS Sensors at ports (w/ exception of Louisville, KY) were deployed as part of the PAWSS Major Acquisition Project and are omitted from this spreadsheet for brevity

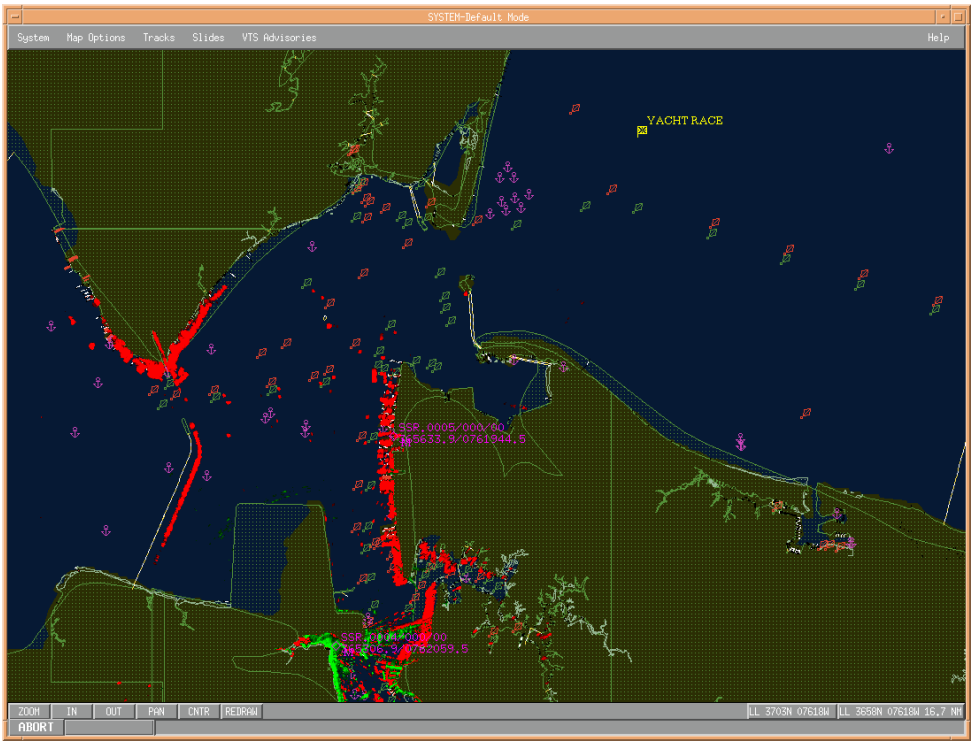
Note 2) 2 of 6 Terma radars were installed by PAWSS Major Acquisition project. These were controlled directly by the MTM-200 but have been connected to CGVTS

Note 3) As part of the PAWSS Major Acquisition Project, the VHF Comms System was upgraded from a non standard Telegenix controller & Ross/Lamda Xcvrs/Rcvrs to Motorola Quantar Xcvrs w/ Command Plus Transceivers. Upgrade to Zetron Control pending

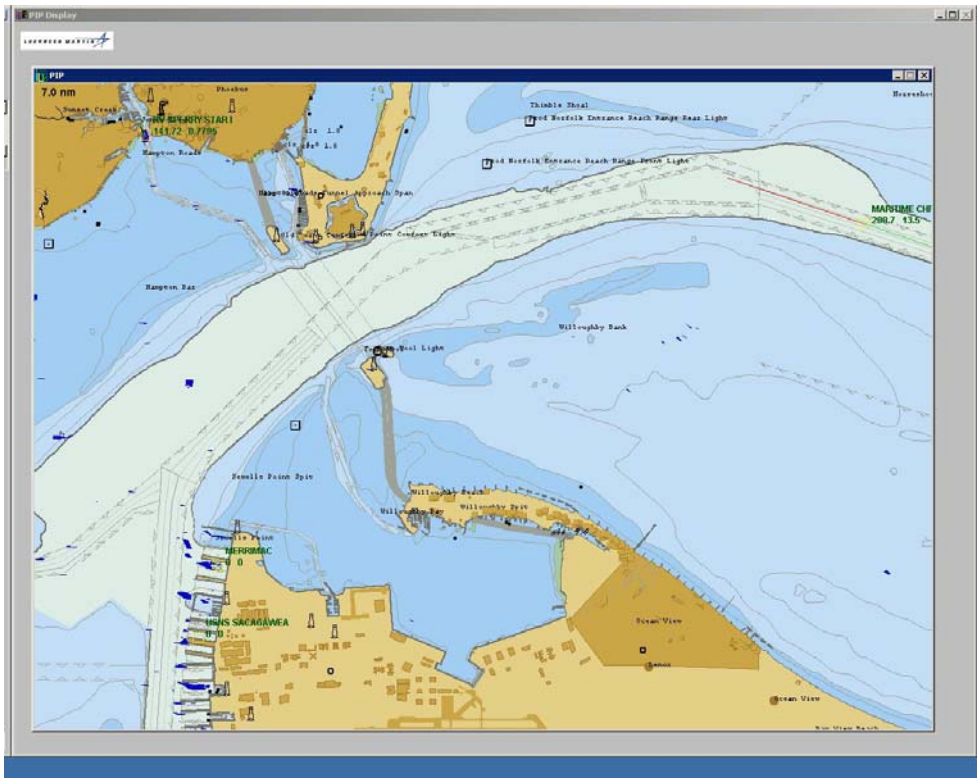
Legend:		Indicates installation as part of PAWSS Major Acquisition Project
		Indicates system used is legacy VTS baseline.
		Indicates current hybrid MTM-200/CGVTS System



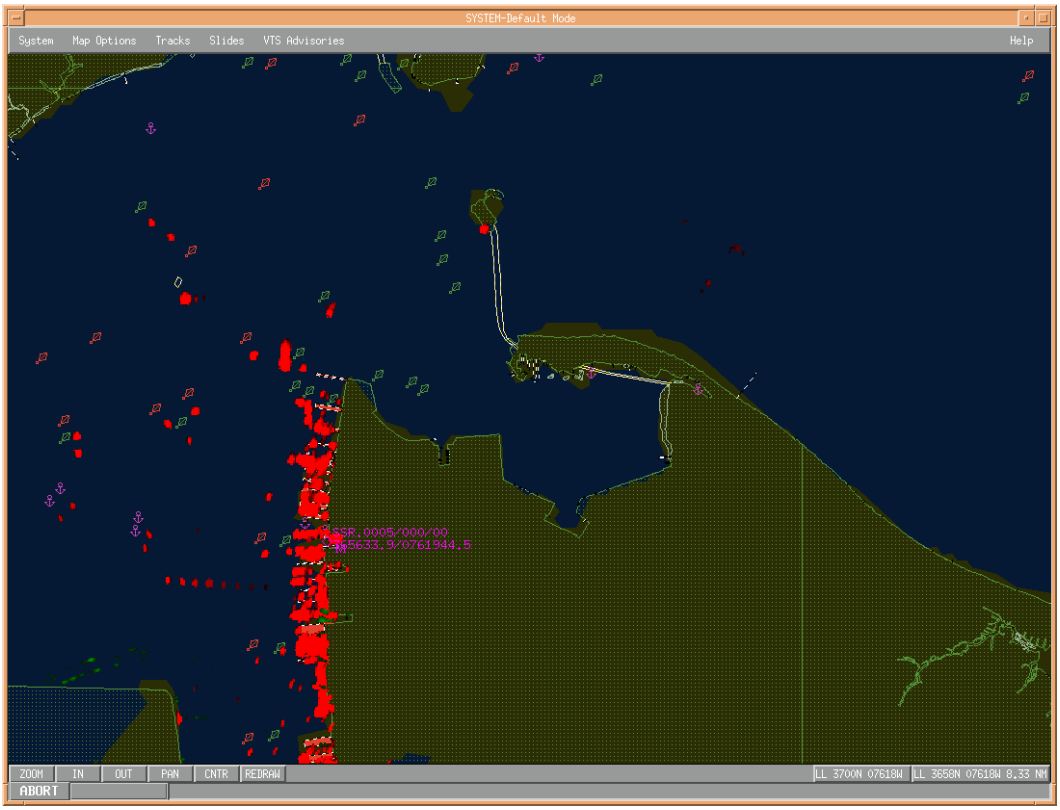
MTM-200 display radar displayed in blue))



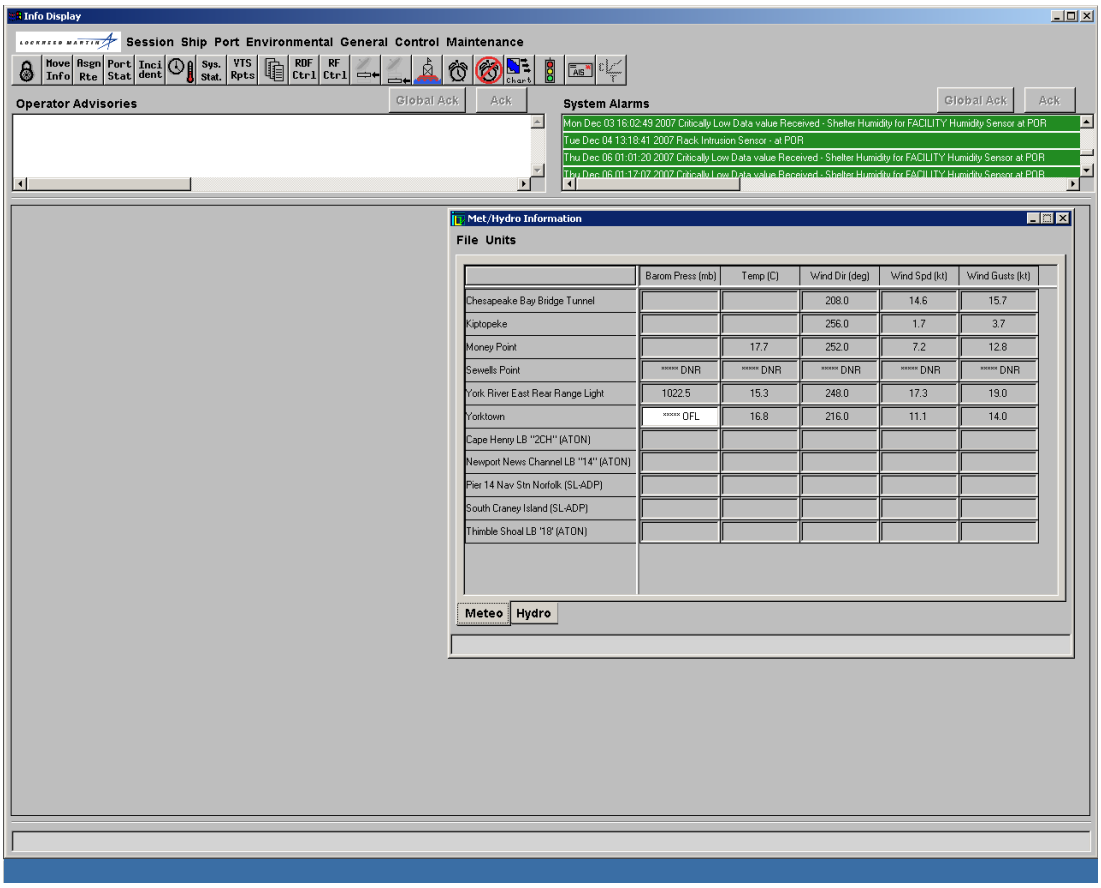
CGVTS display – radar displayed in red



MTM-200 display of Hampton Roads area



CGVTS display of similar area of Hampton Roads



MTM-200 display of weather sensor information
No similar CGVTS capability